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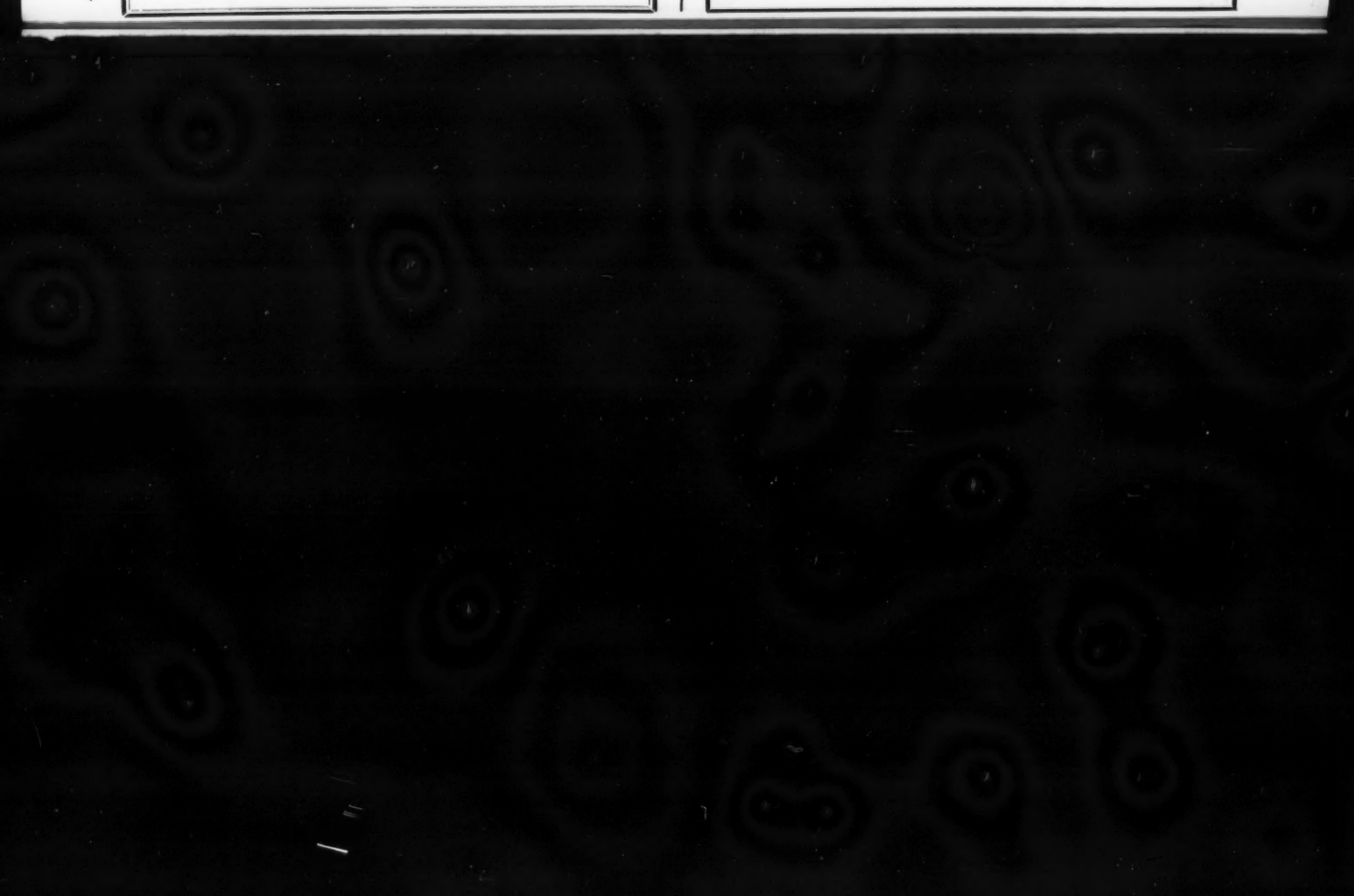

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Censorship regulations now allow firms to publish details of their wartime production of non-secret stores, etc., up to June, 1944. The following data of our Companies' War Effort are by no means exhaustive since lack of space prevents comprehensible description of many of our Manufactures and Products—but the quantities and particulars cited may not seem unworthy of record :—

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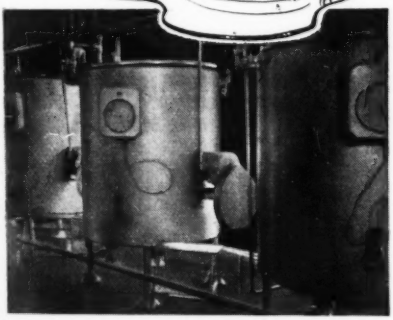

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Our "Inefficiency"

THE theme of the inefficiency of British industry is well worn. We have ourselves not scrupled to give voice to the disquieting thoughts that arise from comparisons which have been made from time to time by our friends across the Atlantic and by many of those in this country who foresee dire consequences if we do not pull ourselves together. There is no smoke without fire, and there is solid justification for some at least of what has been said. We have been at war now for nearly six years. Our industry has been more depleted in man-power than that of any other major nation. We have received less sustenance in raw materials and in food than some other nations at war. Our works have been subjected to enemy attacks. For five years we have never been wholly free from those attacks and at times they have risen to a violence that left us a little breathless, and happy if we could keep production going without bothering too much about the morrow. What wonder that under these conditions we seem a little shabby to those who have suffered from none of these things?

There is, too, the danger of judging British industry by its appearance. The traditional jibe against the alleged British habit of "muddling through" is not altogether undeserved. We are prone to get ourselves into "a hell of a mess," and ultimately to emerge with something quite good from it all. It looks inefficient. To the tidy mind it must *be* inefficient; but somehow it works, and it seems to work quite well.

Our rough island story is full of such events. Amid the undoubted "mess" of war-time difficulties, of enemy bombing and a thousand other handicaps, none of which make for efficiency, we have done pretty well. We invented the tank during one war and we have so developed it during another that Field-Marshal Montgomery has declared the 17-pounder British tank gun to surpass the performance of any German tank gun encountered so far. He has further declared that British armour has shown itself so much superior in battle to the German armour that "if Rundstedt had been equipped with British armour when he attacked in the Ardennes he would have reached the Meuse in 36 hours. If the 21st Army Group had been equipped with German armour it could not have crossed the Seine and achieved the remarkable feat

On Other Pages

of cutting off the whole Pas de Calais area in eight days." We designed the Spitfire which saved Britain and the world in 1940 and has given so good an account of itself ever since. We developed the jet-propelled aeroplane. We designed and built the Lancaster which has been described as "a unique achievement in man's conquest of the air—a symbol of Britain's scientific and engineering genius . . . the world's champion weight-lifter." The Mulberry harbour which made invasion possible was designed and built by British engineers and by British firms. It will not be forgotten that Mr. Churchill foresaw a need and ordered that need to be met, adding that he did not want to be informed that the problems were too difficult.

It is recorded that when Marie Antoinette made her often difficult requests, her Controller-General, Calonne, was wont to reply: "Madame, if it is but difficult, it is done; if it is impossible, it shall be done." That has been the response of British industry throughout the war to the demands of the Services. Radiolocation, the protection of ships against the magnetic mine, the development of DDT to check typhus—that scourge of every army in previous wars—the technique of dam-busting, and an unnumbered host of other achievements can be put to the credit of British industry and British scientists.

Let us not forget that all these things required not only to be devised and to be designed, but had also to be put into production. Some of them were devised, or partly on the drawing-board, before the outbreak of war, but production was entirely a war achievement. This country was far from ready for war when the trumpets sounded. Our air force was pitifully small; our protection against the *Luftwaffe* so meagre as to be negligible. Those who lived in London in the autumn of 1940 and who suffered from the hail of missiles from the sky to which not only was there at first no reply, but against which no adequate reply could be attempted for some time, will not need to be told that. In spite of all, British industry did not prove itself inefficient. It produced the goods. True, it did not produce them in the quantities that America was able to do, with her great reserves of labour and absence of dislocation of transport through bombing; but then mass production is not necessarily the British answer to problems of production.

We are the first to acknowledge how much help we have received from America. Without that help the war would have dragged on for years till we could have produced the tools by ourselves. But our production has been immense, as the White Paper issued some months ago has shown. British industry requires rehabilitation after its great struggle; but it is not basically inefficient. We admit that much requiries to be done; and what that is we shall discuss next week.

NOTES AND COMMENTS

Funds for Development

IN order to run an association effectively it is essential to have enough funds for development. Too often the subscriptions of members suffice for little more than to pay staff salaries and office expenses, and wise officials will do well to look round for some further source of finance. This year's report of the Institute of Fuel contains a good example of how this end may be achieved. Dr. E. W. Smith, the president—who, incidentally, has "gingered up" the Institute generally and doubled its membership—has been largely responsible for organising a guaranteed fund or £5000, over and above the annual subscriptions of members, for getting on with research and development work which will be to the advantage of all fuel users. It says a great deal for the informed enthusiasm of Dr. Smith and his coadjutors that a very large proportion of the required sum has already been promised, and we note that substantial contributions to it have been made by I.C.I. and Unilevers, as well as by many other concerns more directly interested in fuel as such. It is also worth observing that contributions have been made also by individual members.

These may be smaller intrinsically, but they go to show that the members of this association are sensible of what is to their best advantage.

Enemy Patents

MR. CHURCHILL, crying in the wilderness in the years before the war, and warning the people of this country against Germany's power to do evil, was lamentably ignored. Lord Vansittart, on whom that particular fold of Mr. Churchill's mantle seems to have descended, has repeatedly urged that this country should be in a position to look after itself better once this war is over. Having brought forward quite recently in the House of Lords a motion dealing with enemy infiltration, the noble Lord rendered an equally valuable public service by calling attention to the problem of enemy patents. This problem was described by a recent writer in THE CHEMICAL AGE, quoted by Lord Vansittart in his speech, in these terms: "This subject of enemy patents is a vital part of how to win the peace." The Lord Chancellor assured the House that the general question was far from being disregarded by the Government.

A Guard for the Future

LORD SIMON also stated that the report, given for the first time in this Journal, of a mass flight of German patents to Sweden, was being closely investigated by the Board of Trade. As regards the number of enemy patent applications lodged with the Patent Office and still secret, Lord Simon said they totalled about 400, all of which had been open to inspection of the Fighting and Supply Departments. Further, our industrialists had made good use of the system by which the Comptroller-General of Patents can grant licences to use enemy patents. As regards the all-important question of future fraudulent machinations, it had been decided that no enemy patents would revert to their owners after the war. What matters most, however, is that the machinery for preventing Germany from waging economic warfare as a prelude to military aggression shall still be working ten, twenty-five or fifty years hence.

David Lloyd George

AMONG the many tributes paid to the memory of Lloyd George none was more ably expressed than that of a former head of the Civil Service, who, in a letter to *The Times*, reminded English readers that we owed to this Welshman "the awakening out of its callousness of our social conscience to the shocking conditions in our country of ill-health, slums, unemployment, and youngsters' treatment, and also the development of public interest in science." The years 1916-18 were filled with vigorous scientific and industrial activity, mobilised, then as now, to defeat a brutal enemy; but we all know what became of the scientific and industrial effort of those days. Several suggestions have already been put forward for a fitting memorial to "the man who won the last war"; to these we may add the successful (and not temporary) harnessing of both science and industry to the chariot of social progress.

New Organic Insecticide

"Geigy 33"

THE Geigy Company has announced another insecticide in the DDT group, known as "Geigy 33." It contains an organic contact insecticide which, it is claimed, is absolutely non-poisonous to man. It is designed primarily for the protection of foodstuffs against attack and for the destruction of insects after infestation.

Basle reports that large-scale laboratory experiments by the company have shown that foodstuffs, particularly cereals, coffee, cocoa, etc., can be protected for many months against many species of insects. "Geigy 33" is made in the form of dust and of an emulsion concentrate for dilution on the site of operations, and is specially recommended on account of the efficacy of DDT in minute doses and of the persistence of its action. A great advantage of the new product, as compared with certain other new insecticides, is the absence of any objectionable and pervading smell, a point of great importance in food protection.

The firm reports that protection is provided by a mixture of 1 part of Geigy 33 powder with 1000 parts of the foodstuffs to be protected, while, furthermore, walls and ceilings of storerooms can be sprayed with 3 parts of the new insecticide in 100 parts water. Geigy 33 is also being produced by the company's branch factory in Spain.

French Chemical Industry

The Position To-day

From Our Paris Correspondent

FRENCH chemical industries are working under great difficulties owing to the scarcity of coal and the lack of raw materials. Factories and plant were not unduly damaged by war or bombing, but the deportation of labour is very serious. A general outline of the position in certain sections of the industry is interesting.

Sulphuric Acid

French production of sulphuric acid before the war was about one million tons a year from 850,000 tons of pyrites of which no more than 150,000 came from French mines. So far this year production has been about 15,000 tons a month, and this, if it does not improve, will mean that French production will reach no more than 180,000 tons this year. Pyrites stocks are not above 80,000 tons and with national resources, at an optimistic estimate, it is unlikely that the industry will be able to produce more than 300,000 tons this year.

Carbonate of Soda and Caustic Soda

This industry, in spite of itself, worked for the Germans during the occupation. In any case, the bulk of the industry was situated in the east of France, there being only one small factory near Bayonne. Immediately after the liberation stocks were counted and it was found that there remained 35,000 tons of carbonate of soda and 5000 tons of caustic soda which had been manufactured for the Germans. Before the war, French production of carbonate of soda was about 480,000 tons a year, of which a large part was exported. At the moment the factory at Tavaux, which started working again at the end of December, is producing about 100 tons a day as well as 50 tons of caustic soda. Unfortunately, coal stocks are insufficient and production may have to be curtailed. The large centre of Dombasle-Varangeville is unable to function at all owing to the coal position.

It is, then, thanks to the factory at Tavaux that both the soap industry and the glass industry in France have been able to carry on during the first quarter of this year. But if the Dombasle factories do not start work soon, the second quarter of the year will find France completely out of carbonate of soda, and the glass industry will probably have to cease functioning.

The caustic soda situation is even worse. The month of March has seen almost the last of the stocks, with the result that the artificial fibre industry has been sorely hit. It is hoped that there will be an improvement during the latter half of the year, but the second quarter is expected to be extremely hard.

In January of this year France possessed no more than 20,000 tons of calcium compounds in stock against an annual pre-war production of 180,000 tons. During the first quarter of the year no more than 15,000 tons were manufactured and about 5000 tons imported. Stocks have permitted the distribution of some 30,000 tons over the first quarter of the year, the bulk having been sent to the Alps, Pyrenees and the Massif Central, while the Paris area is sorely lacking these compounds.

Sulphur

France needs to import about 90,000 tons of sulphur, particularly for agriculture. At the time of the Armistice stocks amounted to 150,000 tons, and the Government was able to cling on to these until the end of 1942. Besides, it was then still possible to import from Sicily. After the invasion of Italy, the situation became serious. The Germans imported small quantities. There is an import plan, however. During the next eight months it is expected that some 60,000 tons of sulphur will reach France and the small quantity of available shipping space will be used for this traffic for the most part. Apart from agricultural needs, the textile industry uses this raw material, and without it the industry will suffer seriously.

Copper Sulphate

Likewise for agriculture, copper sulphate is a prime necessity. Normal demand is about 70,000 tons a year. In 1941 manufacturers delivered 58,000 tons, in 1942 they delivered 34,000 tons, in 1943 only 27,000 tons, and in 1944 only 12,000 tons. An import plan has been drawn up for the next eight months. Some 15,000 tons of copper and 30,000 tons of sulphate will be imported; 15,000 tons of the latter will come from Britain. The position, therefore, is not desperate.

A method for determining the total lime content in sulphite cooking acid (raw acid) is given by O. Samuelson, of Mo & Domsjö A/B, in *Svensk Papperstidning* (Feb. 15, 1945, p. 55). In this, SO_2 is first displaced by HCl. The free acid in the resulting solution is titrated with NaOH, and the metal cations are then exchanged against hydrogen ions. The acids thus liberated are again titrated with NaOH, and the lime content is calculated from the difference between these titrations. The analysis may be carried out in 20-30 minutes and the error is less than 0.5 per cent.

Patents and the Public Interest*

What is a Patent Monopoly ?

by W. WARREN TRIGGS, M.Sc., B.E., M.I.M.E., A.M.I.E.E.

AFTER much thought and deliberation, I have chosen for the subject of my address the patent system in its relation to the public interest, because I feel that this is a subject which is very much in the public mind to-day, and because I believe that at the present time, when the patent system is coming under the fire of critics both in this country and in the United States, it is of great importance that all those with any real knowledge of the subject, should rally to the defence of a system which is demonstrably vital to the well-being and advancement, not only of this country, but of humanity as a whole. And here I pause to ask, who can speak with greater authority on the patent system than the patent agent, whose whole professional life is spent in constant and the closest association with invention and inventors, with research and research workers, and with industry and industrialists? I propose, therefore, this afternoon to examine briefly the character of the so-called patent monopoly, the nature of the attacks that are being made upon it, and some of the immense advantages deriving from that system.

Definition of "Monopoly"

The word "monopoly" is defined by Webster as follows: (1) The exclusive right, privilege, or power of selling or purchasing a given commodity or service in a given market; exclusive control of the supply of any commodity or service in a given market; hence, often in popular use, any such control of a commodity, service, or traffic in a given market as enables the one having such control to raise the price of a commodity or service materially above the price fixed by free competition. (2) A grant or charter of a monopoly (in sense (1)), etc.

The *popular* sense of "monopoly" in the above definition is to be particularly noted, for it is submitted that the whole basis of the attack in relation to patents rests upon this popular meaning and upon a complete failure to understand the kind of monopoly which is conferred by a patent and the clear distinction which exists between the patent monopoly and the kind of monopoly so freely granted by the monarchs of England in the 16th and 17th centuries for the reward of favourites or for the raising of revenues. The latter were monopolistic rights to manufacture and sell things already in existence such as salt, sulphur, and starch, and the recipients of these royal favours were not the discoverers of the things which they had the sole privilege of making or selling. The only consideration for the grant of such a monopoly was the possession of a long purse, and a willingness to place it at the disposal of a needy monarch in return for the grant of a royal favour.

On the other hand, a patent monopoly is a reward for the invention or discovery of something new, something before unknown, something added to the sum total of human knowledge, utility and well-being, something which the inventor or discoverer, if he were indifferent to the acquiring of fame or fortune, might easily have withheld from his fellow men. By the monopoly that goes with a patent, therefore, the Crown recompenses, and for a limited time, protects, the inventor or discoverer who gives to the world the use and benefit of his invention or discovery. It has, in fact, been truly said that, on the one hand, monopoly in the old or popular sense deprives the public of something to which it had free access before the grant of the monopoly while, on the other hand, the patent monopoly gives to the public something which was unknown to it and non-existent in the public domain before the grant of the patent monopoly, and something which in all probability it never would have had but for that grant.

An American View

It is, indeed, a thousand pities that the word "monopoly" has become so firmly attached to the word "patent." A patent merely gives to the patentee the right for a limited term, to exclude others from making, using or selling the new thing which he has invented or discovered. It is a property right, and is no more a monopoly than are other property rights. This truth has been most aptly expressed by the late Dr. J. H. Wigmore, Dean Emeritus of North-Western University Law School, in an article which he wrote for a symposium on the patent system which appeared in the *New York Journal of Commerce* in March, 1943. In that article, Dean Wigmore expressed with so much more cogency than I can hope to achieve, the idea that I wish to put to you, that I cannot refrain from permitting myself the luxury of quoting the following extract:—

"1. Let us test this thesis by some simple illustrations:

(a) My right to personal corporal safety and freedom means simply that the law will keep anyone else from striking me with a

* From the Presidential Address to the Chartered Institute of Patent Agents. Published with the authority of the Institute.

weapon or making me a slave. In short, the law grants me a monopoly in the use of my corporal person.

(b) My right to domestic relations means simply that the law will keep anyone else from hurting or abducting or seducing my child or my wife. In short, the law recognises my interest in them as exclusive, *i.e.*, a monopoly.

(c) My right to property, *i.e.*, the house or office, or the motor car or the books in my library, means simply that the law will keep anyone else from intruding or damaging or appropriating the thing. This is a monopoly of its use for me.

(d) What, then, is a patent right? It is simply the law's promise to keep anyone else from making and vending the thing that I make according to the formula that I have invented. The social merit at the basis of this right is the general conviction that such invention deserves firm encouragement. But, once the right is so recognised, it is no different in nature from the fundamental rights of property, personal security, and domestic relations, as above analysed. There is nothing peculiar to it as a monopoly. They are all monopolies."

It was a clear recoghition of this fundamental distinction between the patent monopoly and those artificial monopolies which are so rightly anathema, which led to the exception of patent monopolies from the wholesale slaughter of monopolies by the celebrated Statute of Monopolies of James I.

It was an equally clear appreciation of the distinction to be drawn between monopolies generally and a patent monopoly in particular, and of the value of the latter to the life and industry of a country that led the framers of the American Constitution—those far-sighted and clear-thinking men—to write into that instrument, Section 8 of Article 1, which empowers Congress "to promote the progress of science and useful arts" by securing for a limited time to inventors the exclusive right to their discoveries. In this connection it should be remembered that only a relatively few years before the framing of the Constitution the American War of Independence had been precipitated by popular resentment against the monopoly on tea held by the East India Company, and it would have been strange, indeed, to find an article in the Constitution sanctioning the grant of patent monopolies had there been no fundamental distinction between such a monopoly and that held by the East India Company.

The Attack on the Patent System

In this connection I think I have read almost everything that has been written in the last two years in criticism of the patent monopoly, and that which is not composed of mere platitudes and popular catchphrases appears to me to rest upon a wholly illogical basis. The main argument, stripped of all verbiage, appears to run thus: Cartels and trade associations are bad as leading to unethical practices and generally to restraint of trade; patents are used to promote such cartels and trade associations; therefore, patents are bad. However, one does not need to be an expert logician to detect the fallacy underlying this argument, even if one were to accept the premise upon which it is based, and which is certainly not acceptable to a very large number of clear-minded people who are sufficiently altruistic to put the public interest before their own. In fact, stated baldly, as I have stated it, the argument offends against every rule of logic.

But in addition to the attack on the patent itself, there has been a large amount of criticism in respect of alleged abuse of the patent system, and while I cannot say in this case that the criticism rests upon an illogical basis, I can and do say that for the most part it rests upon a basis which is completely non-existent, and the latter basis seems to me to be, if anything, a degree worse than the former. This question of the alleged abuse of the patent monopoly has already been authoritatively considered and exposed in the report on "The British Patent System" published by the Council of the Institute in April, 1944, and as support for the statement I have just made, I quote the following extract from that report.

The Institute's Report

"Speaking from a wide experience of its members, this Institute does not believe that patent monopoly rights are misused to any appreciable extent and it holds the definite opinion that patent owners in the vast majority of cases exercise their rights in a manner which is entirely satisfactory to the general community. It is not aware of any public dissatisfaction with the commercial development of inventions in this country, or that the true benefits of particular inventions have been withheld due to monopolistic practice. It would seem, on the contrary, that the fullest effects of competitive enterprise, have been experienced in all the main fields of invention, *e.g.*, aircraft, radio, motor-cars, and plastics."

Thus, it can be seen that the attack on the patent system is wholly illogical or largely based on non-existent abuses. Of course, it cannot be denied that there has, from time to time, been some abuse, or attempt at abuse, of the patent monopoly, and particularly in the United States of America, where the patent law contains no provisions for checking abuse such as are contained in section 27 of our Patent Act. However, even if there be some abuse, mere

abuse of a system is not an adequate reason for the suppression of the whole system, but indicates merely the necessity for curing any defects in the system which may make such abuses possible, and, as you know, this aspect of the question is being carefully investigated and considered by a strong committee set up by the Board of Trade.

Benefits Derived from a Patent System

The patent system of any country rests upon the premise that it will provide incentive to invention and investment of capital in order that new industries may be developed, and existing industries improved, for the betterment of the national standard of living. This, in fact, is specifically stated in a proviso to Section 27 of our Act.

To ensure this result, certain conditions must be satisfied before the patent grant will materialise. An applicant for a patent must in the first place have made a contribution of something new and useful to the sum of human knowledge and one which is produced by the exercise of inventive faculties. Further, in exchange for the grant of exclusive privileges for a limited period, the applicant for the patent must also make a full disclosure of all the essential features of his invention so that upon the expiration of the period of his patent monopoly the public will enjoy the full benefit of competition in making and using the invention. Not only must the inventor find and disclose a use for the invention, but he must also disclose how to use the invention on which he obtains his patent.

This creates a powerful incentive on the scientist or experimenter to direct any knowledge he may discover into channels of usefulness and to relate his findings to the everyday life of the people and to make his ideas practical. Without this spur, much scientific work might remain of purely academic and laboratory interest. Thus the patent system makes public the knowledge of inventive progress and, what is even more important, it preserves a written record of such progress in all the arts, which is thoroughly classified in a form suitable for prompt and convenient reference and without which further progress would be rendered impossible. It may well be that some of the ancient civilisations produced many useful inventions capable of further development and wider adaptation, but these were lost to them and remain unknown to us precisely because these peoples had no arrangement or practice such as exists in the modern patent systems for maintaining a written record. To many it would seem that this system of record might well be a justification for the grant of many of the so-called trivial patents of which much is being heard to-day, since no doubt many such trial disclosures may be the means of implanting the germ of a really great idea in the brain of some later investigator.

But it is a truism, which perhaps some inventors are sometimes inclined to forget, that invention alone does not account for industrial progress and that what is required, in addition, is the commercial development of the invention. To this end, speculative capital must be made available, and it is abundantly clear that speculative capital will not be forthcoming to back new inventions unless those providing the capital are given at least a limited period of years during which they may be protected against the competition of others who might be tempted to take advantage of the development without having had to share in any of the risks involved. In addition, therefore, to giving an incentive to individuals to invent, the patent system offers an inducement to the risking of capital essential for the practical development of inventions.

Summary of Advantages

Some of the benefits to the public that flow from a system for granting patent monopolies for a limited term may accordingly be briefly summarised:

(1) It confers upon the public something which it never had before and something which in all probability it never would have had but for the possibility of securing the patent monopoly.

(2) It stimulates and promotes industrial progress not only by providing an incentive to individuals to invent, but also by inducing a flow of speculative capital essential for the practical development of inventions for the benefit of the public.

(3) it creates a powerful incentive to the scientist or experimenter to direct any knowledge he may discover into channels of usefulness, and effectively prevents such scientific work from remaining for all time of merely academic and laboratory interest.

(4) It preserves a written record of progress in all the arts, which is thoroughly classified in a form available for prompt and convenient reference and without which further progress would be impossible.

Having attempted briefly but by no means exhaustively to deal with the advantages of the patent monopoly from the point of view of the public interest, it is perhaps unnecessary for me to add that I fully realise that all that I have said has been said before, but I make no apology for telling a tale that may be more than twice told for the reason that, although criticism of the patent monopoly, so far as I have been able to observe it, is to a great extent based upon ignorance, confusion of ideas, or blind political prejudice, it is nevertheless rampant and widespread to-day, while those who can speak from knowledge and experience of the real public value of such monopoly are for the most part inarticulate.

Colonial Development Plans

Imperial Institute Report

SIDELIGHTS on some of the many plans in preparation for the fuller development of the British Colonies, in order to make their natural resources available to the post-war world, and to improve the standard of life of their peoples, are shown in the annual report of the Imperial Institute, South Kensington. More intensive geological surveys in the Colonies are contemplated, in order to locate further mineral deposits of economic value. The committee considering the post-war organisation of Colonial Geological Surveys submitted its views to the Colonial Secretary in October. Comprehensive statements are also being prepared on Colonial building materials of mineral origin.

West African Lignite

Substantial deposits of lignite, believed to be the first discovery of solid fuel recorded in the Colony, have been found in Sierra Leone. These are comparable with Southern Nigerian lignite in quality, and a recent inquiry at the Institute suggests that their use for brick-making and other local purposes is contemplated. Large samples from two trial workings are being examined at the Institute, and a third from another site is expected. A firm approached by the Institute is showing an interest in an unusual rock, resembling soapstone, from Kenya. India's remarkable industrial developments during the war have aroused interest in her natural resources in fuels. A leading metallurgical firm in Britain has been assisted in making a general survey of information on the coalfields of India.

Growing use of bentonite has resulted in inquiries to the Institute about deposits in Canada, New Zealand, Kenya, and India, and the uses of the mineral in oil-well drilling, fine chemicals, photography, as a binder in moulding sands, and as a sealing compound for leaking dams. Questions have also been answered concerning the possible use of vermiculite from Empire sources for pre-fabricated building units, and for use in paints, inks, linoleum, and oil-refining.

Eight samples of tungsten were sent to the Institute by the Wolfram Board at Jos, Nigeria. Four of them showed on analysis more than 70 per cent. of tungstic oxide, two others between 60 and 70 per cent., and the other two about 45 per cent. Crude ochres from Devon and Cornwall were also examined, and a sample of euxenite from British Guiana has been considered as a possible commercial source of uranium.

In Nigeria and Southern Rhodesia the possibilities of local grasses for paper-making are being studied. In Sierra Leone there is a Post-War Reconstruction Committee which is concerning itself among other things with piassava fibre for making brushes and with the extraction of oil from palm kernels.

Experiments with Kok-Saghyz

Experimental cultivation in Britain of dandelions grown from seeds sent by the U.S.S.R. after the fall of Malaya have yielded interesting results, according to the report of the Rubber Department, which is directed by the London Advisory Committee for Rubber Research (Ceylon and Malaya). The seeds were distributed by the Royal Botanic Gardens, Kew, for experimental cultivation, and the harvested plants were submitted to the Institute to study methods of extracting the rubber, and to make a detailed examination of its quality. Plants grown in Egypt were also forwarded to the Institute for examination. "Suitable methods of extraction were devised, using the rod mill device," the report states. "The dry roots contained, on an average, up to 10 per cent. of rubber, which was found to be nearly as good as plantation rubber. The yield per acre, however, is much smaller than that of plantation rubber, and the cost of production very much higher. In spite of the rubber shortage, labour and good agricultural land could not be spared in Great Britain to grow the crop on an extensive scale."

Crotonic Acid

Commercial Samples Available

AS indicated in our last week's issue (p. 293), crotonic acid, is being manufactured on a commercial scale in Canada by Shawinigan Chemicals, Ltd. We are now informed by Shawinigan, Ltd., of 113 Foxley Lane, Purley, Surrey, that samples are now available from them in this country.

Crotonic acid is an α-β-unsaturated carboxylic acid containing four carbon atoms as indicated by the formula: $CH_3.CH:CH.COOH$. The possible uses of the acid, Shawinigan, Ltd., state, have not been thoroughly evaluated, but a number of interesting fields for research are being considered: (1) Co-polymerisation of crotonic esters and related compounds with butadiene, styrene, vinyl acetate, vinyl chloride, and similar monomers. (2) Polymerisation of crotonic esters to give polymers similar to methacrylates. (3) The preparation of modified drying oils from non-drying oils by crotonic acid addition. (4) The condensation of crotonic compounds in a Diels-Adler reaction and the production of modified ester gum resin. (5) The production of cellulose tricrotonate. (6) The synthesis of amino acids, pharmaceuticals, plasticisers and various organic intermediates

Fume Control with Drying Oils

A Chemical Engineering Problem

IN the course of a paper read before the London section of the Oil and Colour Chemists' Association on March 23, at Mansion House, Mr. C. W. A. Mundy, A.R.I.C., described a new means of fume elimination in the heat-treatment of drying oils in open vessels. The heat-treatment of drying oils, said Mr. Mundy, was a chemical engineering problem, and it was plain that in this connection an ever-increasing number of chemists should acquire chemical engineering training, that some engineers should acquire a knowledge of oil chemistry, and that both should work in close collaboration. It was also clear that the research stations should have chemical engineers on their staffs, to study the operation of heat-treatment.

Types of Plant

Dealing with the types of vessel in which drying oils were heat-treated, Mr. Mundy said there was little doubt that for normal stand oils an overwhelming majority of chemists would say that the open type of vessel gave the better product, using as criteria absence of odour, flow, and lowness of acid value of the product, and gloss of the dried film. Simplicity of apparatus and a high quality product were obtained at the expense of a considerable fire hazard, and the problem of coping with large volumes of fume. On the other hand, when using the closed pot there was no fire hazard, no fume problem, but a product of less intrinsic value.

After a discussion of the pre-treatment of drying oils, the processes of refining, the adjustment of acid values, and the removal of colour, the lecturer approached the problem of the plant used. He said that for many heat-treatment processes open pots constructed of mild steel gave excellent results; therefore, for ordinary stand oil production there was no need for elaborate plant constructed of expensive metals. As for shape, the usual pot had vertical sides; yet rather better results were obtained by having pots considerably wider at the top than at the bottom.

Materials of Construction

Where paleness of colour was of first importance, aluminium and stainless steel pots had their proper function. Aluminium was difficult to clean, although admirable for the construction of closed pots. Copper bottoms were used invariably, usually detachable for convenience of replacement. Stainless steel of the right type for many purposes was well worth the extra cost, welded pots having integral bottoms giving excellent life. For reaction vessels the metal was ideal, standing up to most conditions encountered in dealing with drying oils.

Where vacuum technique was employed, the spherical vessel was indicated. The use of evacuated vessels, however, was of little assistance in obtaining polymerised oils of low acid value unless the vacuum obtained was within a few mm. of absolute vacuum, a condition very difficult to obtain and even more difficult to maintain. Cleaning of stainless steel or steel vessels was a comparatively simple operation, but it was difficult with aluminium vessels. It was helpful to have the fume hood or cover of the vessel constructed in galvanised steel. That part of a heat-treatment vessel did not come into contact with the oil under treatment, but it became coated with a thick layer of oxidised material. In stainless steel or aluminium construction, great difficulty was experienced in removing that deposit; but with zinc-coated steel it could be removed with comparative ease. Although the lecturer thought the future lay in the use of much larger kettles, of five or ten tons capacity, a number of difficulties had to be overcome in the use of vessels of that size. When the reaction was carried out in small vessels, heat was dissipated very rapidly and control of temperature was fairly simple. In large batches the process would readily get out of hand, even in normal heat-treatments of varnish oil, while in processing the newer types of pre-oxidised oil it was essential to have complete control of heating and of cooling. External heat exchangers had been used for that purpose, but internal ones were generally more efficient and certainly much easier to operate. Cold air blown into the hearth had been used for cooling, but often it did not give nearly the cooling back effect needed, and the use of steam was more effective.

Fume-Control Apparatus

Coming to fume control, the author described a simple and effective apparatus. The great majority of fume-removing systems, he said, depended on the use of water sprays. The spray was effective in inducing a current of air over the surface of the heat-treated oil and in carrying away the suspension of fatty acids, etc., generally referred to as fume. Owing, however, to the fact that the fume/air mixture was travelling in the same direction as the spray, effective wetting was difficult to achieve. Moreover, when it was considered that the fume was largely a fatty acid suspension in air, the choice of water for wetting was not consistent with well-known physical laws. The addition of wetting agents to the water effected an improvement, but the use of oil

in the sprays would undoubtedly lead to further improvement. It was found by experiment that virtually complete elimination could be obtained in an exceedingly simple manner, not only of the suspended fog-creating component of fume, but also of the gaseous part. The fume was drawn into a stream of scrubbing liquid by a pressure difference set up either completely or in part by the scrubbing liquid itself. That was achieved by the use of a Venturi tube or a simplified device such as an orifice meter, through one limb of which the scrubbing liquid was pumped; the fume was sucked in at the side limb, and so effectively scrubbed that only air and scrubbing liquid were vented. A circulating pump delivered liquid at the desired pressure and velocity to the Venturi assembly, where the induced fume-laden air was dealt with, the liquid and air being vented into a settling tank, de-aerated, and then re-circulated. The removal of fume was so effective that no stack pipe was required. Moreover, since each individual heat-treatment vessel could conveniently be dealt with independently, fire hazard could be much reduced or eliminated.

The condensed fume was found to be composed mostly of the component acids of linseed oil. It could be recovered readily if aqueous wetting agents were used, and redistilled to give a good quality fatty acid. When oil was used as the wetting agent, the fatty acid became dissolved in it and the excess could be withdrawn, making quite good fuel. In a fuel-oil-heated plant the fuel oil itself might be used very conveniently as the scrubbing liquid, when the fume was condensed, and might be drawn off and burned with the bulk of fuel oil.

Parliamentary Topics

Coal By-Product Industries

IN the House of Commons last week, Mr. J. Griffiths again called attention to the importance of coal-based industries. He asked Major Lloyd George what plans were in preparation by his Department for the development of coal by-product industries and, in particular, fuel from coal in the post-war period.

Mr. Tom Smith: My Department is working in close collaboration with the D.S.I.R. in regard to the further development of processes for the extraction of oil from coal. Much progress has in fact taken place during the war. By-products from coal are already produced on a large scale by the carbonisation industries, and the production of coal-tar fuel, as a substitute for imported liquid fuel, has been expanded during the war from less than 100,000 tons to over 600,000 tons.

In reply to a question from Mr. Griffiths as to whether the Department had prepared its own plan for national development in this matter, Mr. Smith could give no assurance at the moment.

Tractor Fuel Oil

Mr. T. Smith told Mr. Granville that the oil supplied for tractors was Pool vaporising oil of good quality. A slight change in the specification was made two years ago to meet war conditions, but this did not materially affect the quality. Consumption had greatly increased during the war and complaints about quality had been negligible.

Monopoly Legislation

Mr. Petherick asked the Prime Minister whether a decision had yet been reached by the Government as to setting up a court of monopolies or some similar body to examine or otherwise to deal with cartels and monopolies.

Mr. Dalton, who replied, said that the form of legislation necessary to give effect to the policy contained in paragraph 54 of the White Paper on Employment Policy was now being worked out.

When Sir A. Southby pointed out that there was, in the public mind, not without reason, a fear that the cartel system would form, in peace, a system of economic and financial dictatorship, just as evil as the political dictatorship aimed at by Hitler and the Axis, Mr. Dalton said that he had heard that view expressed.

Wolfram Prices

Commander Agnew asked the Minister of Supply what price was being paid for wolfram drawn from the Cligga mine immediately before the mine was closed; and what price had been paid for any wolfram subsequently imported.

Mr. de Rothschild: The answer to the first part of the question is 100s. per unit. Purchases abroad since that date have been at 75s. per unit f.o.b., except for one long-term contract, made in 1942, at 100s.

Asked whether the Ministry would consider re-opening the Cligga mine, and thus keep our own men employed, Mr. de Rothschild said he would consider that.

Development of Palestine

Replying to Mr. Astor, Colonel Stanley said that the technical proposals of the Lowdermilk Plan for the development of Palestine were at present the subject of private technical investigation.

Improved methods of preparing a number of dialkyl and trialkyl lead salts are recorded by Calingaert, Dykstra, and Shapiro (Ethyl Corporation Laboratories) in *J. Amer. Chem. Soc.*, 1945, *67*, 190.

Metallurgical Section

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Chemical Products from Metal Works

Potential Post-War Developments

by A. G. AREND

ONE of the most probable results of war-time research is likely to be seen in improved methods of preparing chemical salts directly from metallurgical products and residues. As a rule, the average works engaged in smelting, refining, and associated metallurgical pursuits is not equipped in the best approved manner for the making of chemicals, as the plant installed belongs to a different category. Attention is devoted rather to producing metal in ingot form, or at least matte, fume, and flue-dust which are disposed of, and oxidised ashes and residues. At times, more metal is made than is demanded by the market conditions, and efforts are made to find fresh outlets for salts of the metals concerned, which may happen to be badly required.

Demand for Metal Salts

An example of this could be quoted in pre-war years when the price of copper fell to an almost rock-bottom figure, while the Spanish fruit growers were crying out for copper sulphate. Another illustration is seen in the fact that when trade conditions generally are bad, paint firms are busy, as overhauling and cleaning-up of plant is carried out while there is time to spare. When zinc in metallic condition was spoken of as being "little more than a drug on the market," zinc sulphate was in demand for lithopone manufacture. Now, however, when all metals come under the category of priority materials, and are obtainable only by special permission of the authorities concerned, these pre-war anomalies are apt to be overlooked. The process of converting a smelting establishment to one for wet product manufacture is complicated by the fact that provisions for sinking wells to make good liquor spillage are rarely on an adequate scale, while pumping systems, evaporators and driers of the best approved type are probably lacking. Wet extraction metallurgical factories, though not thus troubled in the same manner, are seldom as fully equipped with evaporators as are regular chemical works engaged on making general crystal salts and precipitated products.

Processes which are not confined to ingot production are those engaged with copper, zinc, nickel, lead and, to a smaller extent, tin. In each instance, advantage is taken of intermediate products to convert directly to the finished state without reducing to metallic condition, thereby obviating much of the working costs. With copper, the intermediate matte which requires to be either roasted for reverberatory smelting, or passed through the converter for casting as anode material, can be more carefully roasted for copper sulphate production. With nickel, the process differs in that, although passed through the converter, the product is still matte in refined condition and has to be roasted to oxide in any case. (This relates to the cube-nickel process, which is to-day competed with by the electric smelting system.) With zinc, calcination affords a means of acquiring a crude zinc sulphate in basic salt condition, together with oxide, which lends itself to treatment with weak sulphuric acid for subsequent conversion to pure zinc sulphate crystals. The more customary arrangement is to roast the material "sweet," *i.e.*, free from sulphur, for subsequent distillation to metallic zinc, but this is rendered complicated where less pure ores containing lead have to be dealt with.

Lead and Tin Products

In lead smelting, the fume is of an impure order when it is derived from the ore, but when emitted from the molten metal it is relatively pure, and, by the modern system of continued heating to specific temperatures, can be directly converted to litharge and red lead. This represents an alternative to starting from pure ingot lead which requires to be again melted, air-blown, and steam-blown, in order to form a similar product. With tin, a much more complicated metal to handle, there are numerous oxide skimmings which have to be reduced back to the metallic condition. Where salts of the metal are required, such as the chloride in stannous or stannic condition, although much of this is formed from the grained pure metal, the oxide crusts can be taken advantage of, even though lead may be present as an impurity. Thus it will be seen that there is no actual dependence on carrying the refining process to an ultimate conclusion where an outlet can be obtained for salts of any of these metals. The intermediate products in each case are less pure than the finished ingot,

but provision is made to eliminate impurities without upsetting the general run of the process.

In converting roasted mattes of copper and nickel to their sulphates, the process for either is more or less the same, except that different temperatures of roasting are used. The presence of one of these metals in solutions of the other presents practical difficulties. What is known as low-temperature sulphatising roasting can be so performed that the matte is largely converted to the sulphate condition, and this involves the use of the absolute minimum of sulphuric acid to draw it into solution.

This, however, does not make the same provision for iron, which requires to be specially separated. For this reason, the ordinary process comprises roasting at a higher temperature so as to render this iron insoluble, *i.e.*, to convert it to the ferric oxide condition. Copper matte is converted to cupric oxide at 704° C. and nickel matte from the converter plant is changed to nickel oxide at 708° C. Although these higher temperatures dispel what sulphur was present as the convenient sulphate and more readily soluble material, all iron is rendered immune from acid attack. The initial grinding process is simple with roasted copper matte, as the material is relatively soft, but some of the nickel mattes, particularly when contaminated with iron, are exceedingly hard, and slow to pulverise, more particularly in the unroasted condition. A good ball-mill can account for 15 cwt. of roasted copper matte to pass through a 16-mesh sieve per hour, but for nickel matte the amount sometimes does not exceed 10 cwt. per hour. The " roughs " are returned to the ball-mill for further grinding, and in some cases the mass has to pass through a 32-mesh sieve.

With zinc, the semi-roasted ore providing a mass partly of zinc sulphate in neutral and also basic condition, and partly of oxide, is often relatively soft, being already partly broken down by the treatment, and is rapidly run through the ball-mill, which in extreme cases is supplanted by the disintegrator.

Small roasting furnaces have a daily output of between 1 ton and about 5 tons.

The other raw or intermediate products, namely, oxides of tin and lead, are to-day handled without the need for grinding treatment. In the case of lead, it is claimed that less nitric acid is required in making the nitrate; with tin, the chloride is formed with less hydrochloric acid.

In dissolving the pulverised mass, except in the less frequent process using nitric acid, which necessitates the use of stainless steel or other corrosion-resisting metal, the stir-tank is simply constructed of wood. It comprises a cylindrically-shaped vat with rotating paddles for stirring, operated by small overhead electric motor, and heating coils near the bottom (see Fig. 1). Although lead lining is largely preferred for the making of sulphates of copper, nickel, and zinc, good oak, if specially selected for the job, is usually sufficient to resist any intrusion of the acid. For the chlorides of tin, selected sandstone slabs fitted together on the outside by tie-rods, for square-sectioned tanks, are substituted. The process is much the same in each case, and consists in allowing a thin stream of the powdered material to descend into the continuously-stirred hot liquor until a certain maximum has been reached. As the dissolving capacity will not pass a certain fine limit, the slight surplus of free acid is in each case got rid of by adding some pure light scale oxide, or hydrate precipitate, to consume these acid traces.

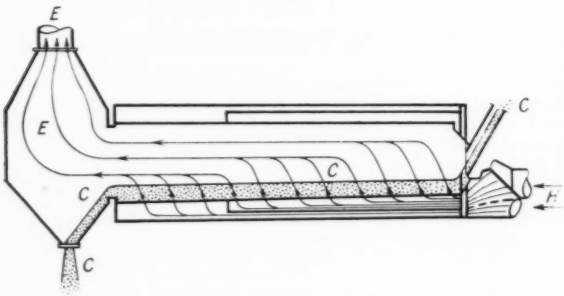

Fig. 1. Drier constructed for drying crystals. Advantage is taken of the loose formation of damp crystals to allow hot air to pass through separate channels as the drier rotates. C, Path of crystals; E. Exhaust air; H. Hot-air inlet (LINK BELT CO., U.S.A.).

The neutral liquor is now filtered. It is run to an evaporator heated by waste steam, and evaporation is continued until a test with the Twaddell hydrometer reveals that it is ready for passing to the crystallising tanks. As regards capacities, one lay-out was as follows. The stir-tank held 660 gallons, the evaporation tank 1100 gallons, and there were some 12 crystal tanks each of 300-gallon capacity. A larger outfit comprised stir-tanks of 2200 gallons, a modern continuous evaporator plant, and sets of 1000-gallon crystal tanks. The washings from the filtered insolubles are preferably

allowed to accumulate in wells sunk in the ground for this purpose; these also receive part of the mother liquor from the crystals. Such liquors are pumped back to the stir-tank as required, instead of using acidulated water. Where iron predominates, although this may be present in the ferric oxide condition, as a safety measure the acid content is not allowed to exceed about 2 per cent., but this excess is maintained as the process proceeds, until the final stages, when it is allowed to be consumed, and from about 7 to 10 lb. of hydrate or oxide addition made to ensure perfect neutrality in the liquors. As regards improvements in the plant, modern diaphragm pumps handle the solutions in record time, and nullify the earlier contention that wet extraction equipment was best erected on a sloping site.

The modern evaporator needs little advertisement in its advantages over the improvised steam-heated tank, but attention may be directed to improved types of rotary filters which do not hold up continuous production (see Figs. 2, 3). Instead of a vacuum being applied only to the slowly-rotating drum, as the inner part is made up of segments the movement of the air is reversed, and it is blown outwards after the precipitate has been collected, whereby it is loosened from its fabric housing. A brush arrangement then gently scrapes off this loosened mass, thereby leaving the fabric in good condition to continue the filtration. Where both precipitate and filtered liquor are in immediate demand, this class of filter appears to advantage, as distinct from the variety which requires perpetual attention to the cloth because of clogging of the pores.

Practical points in crystallisation differ in each case, although the *modus operandi* is much the same. At 100° C. a maximum of 73.5 parts of copper sulphate per 100 of water can be retained, whereas with nickel sulphate the figure is 83.7 per 100, while with zinc sulphate above 40° C. decomposition to the basic salt can occur. The usual commercial zinc sulphate contains 43.85 per cent. water of crystallisation, according to the formula $ZnSO_4.7\ H_2O$, and thus demands more careful handling. The return of surplus mother liquor depends on the impurities which are liable to accumulate, because,

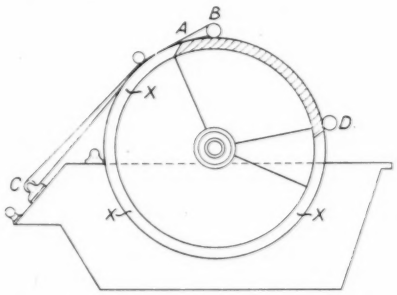

Fig. 2. Special rotary vacuum filter (side elevation through centre).

Vacuum is exerted at outer channel X *only. Air is reversed in segment from* A *to* D. *Cord attachment functions between* B *and* C. *Precipitate is loosened and partly subdivided from* B *to* D *and largely falls off at brush* D, *which also cleans up surface of cloth. A second brush can be installed beneath* D *where necessary.*

although small quantities of the one metal may be present in the main salt solution, its presence can often be by-passed. Thus, quite good copper sulphate crystals can be obtained, although the remaining liquor retains up to some 300 grains of nickel and 350 grains of iron per gallon To continue returning such liquor would only pollute the initial stir-tank contents, and a time comes when these have to be dispensed with. The greater solubility of zinc sulphate likewise allows nickel sulphate to be crystallised out without interference.

Where the regular chemical factory usually

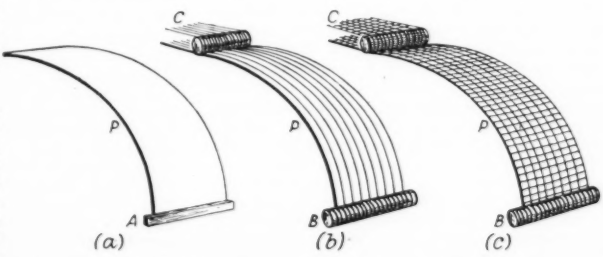

Fig. 3. Showing the face of the filter cloth, on the rotary vacuum filter, with precipitate (*P*) on top.

The earlier style of filter (a) made no provision for loosening the mass on the surface, which was coarsely removed by scraper device A, *leaving the cloth in unclean condition. Later models show the effect of reversing the air as a slight pressure in place of vacuum, with cord attachment (b) converting the precipitate into a series of loosened channels, or with cord-netting attachment (c), as a series of loosened squares. These largely fall off by their own weight, when the brush arrangement* B *almost completely removes the remaining mass, leaving the cloth clean for uninterrupted use.* C *represents the end-point of the cord traverse.*

scores over the adapted metallurgical works is in the final drying treatment, alike for crystals and precipitates. Thus, apart from the foregoing crystal salts, tin oxide precipitate for enamels, and precipitated metallic lead for marine paints, have to be dried before marketing, and up to 1943 were somewhat slowly dealt with.

One of the best foreign designs of drier comprises what is known as the scoop-type plant, in which the damp material, besides being passed through a rotary tunnel, is continually scooped up, exposing fresh surfaces to the dry air, whereby as much as 2 tons can be dried per hour. This scooping action, although probably facilitating the most rapid rate of drying, tends to break up crystals, and is really best suited only for precipitates, as fresh unbroken crystals usually fetch the highest price.

The latest rotary drier, which is specially constructed for crystals, involves a different principle. The wet material, as received in washed condition from the crystal tanks, is continuously fed in at one end of a drum-shaped rotating plant. Instead of the hot air only passing over the material, which may or may not be scooped up, a series of ducts is provided which act in a venting capacity. Hot air has thus to pass through the crystal layers at different points to make egress while the whole is rotating. The surfaces of the individual crystals being continually turned and freshly exposed to the heat, all surplus water is removed in the most expeditious manner, without any risk of pulverising the material. Although the moisture content had to be reduced from 48 per cent. to 18 per cent. by heating at 99° C. and rotating at 1.7 r.p.m., driers 35 ft. long and 11½ ft. in diameter permitted zinc sulphate crystals to be continuously dried at the rate of 8000 lb. per hour. Although details of this type of plant only came to light in 1944, they reveal that modern metallurgical works are capable of turning out crystal salts and precipitates from their metals according to the latest and best approved methods, and are thus enabled to compete in all markets.

Soda Briquettes in the Steel Industry

Sulphur Reduction in Iron

SODA briquettes are composed principally of soda ash compressed into pellets approximately 1¼ in. long, 1 in. wide and ⅝ in. thick, and usually packed in 100-lb. paper bags. They are used by the steel industry and foundries as an efficient and inexpensive material for the reduction of sulphur and the physical cleansing of iron. They make possible the reduction of sulphur contents of from 30 to 70 per cent., depending upon (1) the height of original sulphur in iron; (2) the amount of briquettes used per ton of iron; and (3) the amount of contact established between briquettes and iron.

Soda ash depends on surface contact to produce the desired results. The form of the briquettes provides maximum surface area and, therefore, increased surface contact. "Dusting loss," encountered principally with the use of ordinary forms of light and dense soda ash, is reduced to the minimum, improving the efficiency of the briquettes and the general working conditions. Basic blast-furnace operators observe that they may burden their furnaces slightly "leaner"—produce more pig iron—yet be certain that they can deliver iron analysing within the required sulphur content to the open-hearth or Bessemer departments.

The material is usually added into the runner at a point as near as possible to the ladle. It is recommended that soda briquettes be used at the rate of from 10 to 14 lb. per net ton of iron, where a sulphur reduction of 40 to 50 per cent. will meet requirements. Where the original sulphur may be extremely high, the amount may be increased to 20 lb. per ton. It is generally considered good practice to use two treatments by reladling rather than to increase beyond 20 lb. per ton, as the efficiency of the additional material is much reduced.

The amount of contact established between the briquettes and the iron is reckoned the most important factor in determining the percentage of sulphur reduction. Under present methods of desulphurising, contact is governed by the volume of the flow of iron into the ladle and the resulting action created. Care should be taken to attempt to utilise as large a stream of iron in each ladle as possible. Where it was formerly the practice to fill two or three ladles at once, improved desulphurising results were obtained by filling one ladle at a time and insuring a fast turbulent stream of iron. It is advisable to skim off the resulting alkaline slag before the treated iron is poured into the mixers, so as to reduce possible erosion between the basic slag and the acid content of brick and bonding materials. In the case of low-manganese iron, it is essential to remove the slag within a relatively short period of time so that sulphur reversion will not occur. A few shovels of hydrated lime spread over the slag help to

overcome the watery condition and enable the operator to skim in a clean manner.

The use of soda briquettes in the foundry is generally with a three-fold purpose: (1) sulphur reduction; (2) physical cleansing of iron; and (3) increased slag fluidity and faster rate of melting when added to cupola charge. In addition, soda briquettes enable the operator to use increased amounts of scrap, thus lowering his cost of metal mix whenever economically possible.

Ladle treatment is recommended where sulphur reduction is of paramount importance. Soda briquettes not only flux non-metallic inclusions to the slag, but also reduce the amount of occluded gases, ensuring a more fluid, fine-grained, and stronger iron. When added to the metal charge, the briquettes react with the regular cupola slag, lowering its fusion point and making the slag more fluid and increasing its refining value. Better melting conditions are promoted, and combustion accelerated, by the liberation of CO in the presence of carbon.

Shot-Peening

Reducing the Fatigue of Metals

THE increased life imparted to stressed materials by " shot-peening," a process for which the less specifically accurate term " shot-blasting " is more commonly used in this country, has captured the interest of a rapidly growing number of engineers and technicians in the U.S.A. Dr. H. F. Moore, Research Professor Emeritus of Engineering Materials at the University of Illinois, has recently published a paper as a result of his studies on this special subject. He uses the term " shot-peening " to denote the process of subjecting the surface of a metal machine part or structural member to a rain of metallic shot driven against it by the momentum of the shot as it is released from the rotating blades of a wheel, or by an air blast. As the shot strikes the surface of the part, it produces a shallow layer of metal whose structure, which is made up of crystalline grains, is distorted.

Shot-peening acts in two ways to increase the fatigue strength of the metal: (a) The tensile strength of the skin is increased, and (b) the effective tensile stress set up by a given load-applied stress is diminished by the compressive stress set up in the skin. It can be applied to irregular shapes, in which heat-treating processes might cause excessive distortion, and with which rolling or drawing processes are not practicable. It can also be used with finished parts, such as springs, or with specific areas of structural and machine parts, as when shot-peening is applied to the fillet of a shaft to offset stress concentration, or to the body of a shaft to resist pitting corrosion. It can be applied to parts such as gear teeth without causing appreciable distortion, while it produces a surface with improved resistance to pitting corrosion under localised heavy stress at bearing points, and also with improved resistance to wear.

Often shot-peening can be used as a surface finish in place of polishing, with actual gain in fatigue strength. Such a substitution often reduces production costs materially. The process is being employed with success to increase resistance to surface damage, such as light bruises, " fretting corrosion," pitting corrosion, and decarburisation.

Metal Recovery

Anion Exchange Resins

A NEW process for recovering valuable and essential metals was announced by chemists of the Permutit Company of New York at the American Chemical Society's eleventh annual chemical engineering symsium. Chromium, vanadium, molybdenum, gold, platinum, palladium, and other metals may be removed from waste solutions by absorption on anion exchange resins under certain conditions. The method introduces another new application for the anion exchange resins, plastics which have become widely used in an economical method of removing hardness from water.

Primarily intended for the recovery of metals now being lost in waste waters, the new method is also expected to be beneficial in reducing stream and harbour pollution in the vicinity of electro-plating and other metal-working plants. Under special conditions, anion exchange resins will completely absorb certain metal salts from very dilute solutions. When complete absorption is no longer obtained, the resins are treated with appropriate chemical solutions to effect recovery of the metals in the solutions which may be 25 or 30 times as concentrated as the original waste liquors. The anion exchange resins undergo no permanent change in the process and may be re-used indefinitely.

In contrast to many previously proposed processes for the recovery of metals of this group, the new anion exchange process provides the recovered metal in the form of a salt which may be used directly in plating or other processes. Precious metals may be recovered more economically by the simpler alternative process of burning the anion exchange resin after saturation with the metal, and as the anion exchange resins are almost entirely free from ash-forming impurities, the residue consists practically of the pure metal.

Welding Galvanised Pipes

Recent Swiss Experience

EXPERIENCE has shown that the low-temperature welding process makes it possible to join galvanised stock of any gauge without injuring the zinc coating. Corrosion tests have proved that this zinc coating is maintained close alongside the welding line, ensuring lasting protection. From Switzerland, where low-temperature welding had its start, a report has been received of the extensive use of this process in the installation of the hot and cold water systems of the new Citizens' Hospital in Basle, where over a mile of pipe was joined with bronze-chrome rod, binding temperature 540-660°C., approximate tensile strength 80,000 lb./sq. in.

Before adopting the method, the city authorities who supervised the building of the project made static pressure and corrosion tests. For the pressure tests, a tank was constructed of 6-in. pipe, cup-shaped covers containing a nozzle being welded to each end. This tank withstood 4000 lb./sq. in. before breaking, a pressure so great that the tank increased $\frac{1}{8}$ in. in diameter. After welding, all pipes were tested at 425 lb./sq. in., although the working pressure for the cold water was only 120 lb./sq. in., and for the hot, at 65°C., 60 lb./sq. in. The completed job had 170 welds in 3000 ft. each of 4½-in. and 6-in. pipe, and every one of them passed the test with flying colours.

The welding procedure was simple. Light gauge pipe or sheet does not have to be chamfered, although a space should be left equal to the metal thickness; but above a thickness of $\frac{1}{8}$ in. a 60-degree chamfer should be given to the surfaces to be joined and a small space left between them. The special flux is then applied with a brush to both ends of the pipe in a band at least one inch wide.

Neutral Flame Used

For overhead welding such as this, an oxy-acetylene torch with a neutral flame is used, the torch being slightly smaller than that for horizontal work, and the weld is started at the lower part of the pipe, building a thin fillet going "uphill." The fact that this alloy freezes very rapidly makes overhead welding possible, although the addition of slightly more heat to the parent metal will make it free flowing, as is desired in horizontal jobs. This feature is particularly important when flanging tubing (30-60 degree chamfer) as it will result in very smooth and thin fillet being formed.

It is the extremely low temperature (540-660°C.) possible with this alloy that makes it successful in the joining of galvanised stock. There is no danger of burning the zinc coating at this heat, and, should overheating occur, the flux will ensure protection of the metal. Further, the joints are leak-proof and have a high fatigue strength since there has been no overheating of the metal. If it becomes necessary to remake a joint or change the tubing, a section can easily be removed by heating the weld to 925-980°C. with two torches.

SIR MURRAY MORRISON, managing director of the British Aluminium Co., Ltd., has decided to retire, after nearly fifty years with the concern.

MR. A. B. WINTERBOTTOM, who joined the staff of the British Non-Ferrous Metals Research Association in July, 1943, after being repatriated from Germany, has been appointed lecturer in electrometallurgy in the University of Manchester.

Because of the shortage of cadmium needed for increased Army requirements, civilian use has been curtailed in the U.S.

A wide post-war use of magnesium and aluminium, not only in aircraft production but in the construction of ships, terminal facilities, lorries and buses, is being envisaged by Mr. Henry J. Kaiser, who revealed that negotiations for the building of a destroyer wholly of aluminium, capable of travelling at 60 knots and of turning on a very short radius, had been completed the day before Pearl Harbour. Construction had to be deferred on account of urgent demand for aircraft.

Foundry Services, Ltd., Long Acre, Nechells, Birmingham, 7, have produced a booklet containing a list of their "Foseco" preparations in aid of good foundry practice. The various compounds are divided under several heads, according to the types of metal for which they are intended. Other sections deal with coatings for dyes, moulds, etc., and with tools and accessories. More detailed literature can be obtained from the company by anyone interested in the chemical treatment and fluxing of liquid metal.

Personal Notes

DR. W. H. GLOVER has been appointed an additional managing director of Courtaulds, Ltd.

MR. R. A. N. DIXSON has joined the Kestner Evaporator and Engineering Co., Ltd., in a chemical engineering capacity.

DR. H. A. KREBS has been appointed to the newly-created chair of biochemistry in the University of Sheffield.

MR. ALAN W. HILL has resigned from the board of The British Drug Houses, Ltd., with effect from March 10.

DR. E. C. R. SPOONER has left the Magnesium Metal Corporation and is now with Sutcliffe, Speakman & Co., Ltd., in a consulting capacity.

LORD TRENT has resigned his post of Regional Commissioner for the North Midland Region, which he has held since the beginning of the war. No successor will be appointed.

MR. D. B. COLLETT, chief labour officer, the Dunlop Rubber Co., has been appointed general works manager of the company's factory at Speke, recently allocated by the B.O.T. on lease for peace-time production.

DR. J. W. LINNETT, research Fellow of Balliol since 1939 and Demonstrator and Lecturer in Chemistry at Oxford University since last year, has been elected to an Official Fellowship and Prælectorship in Chemistry at the Queen's College, Oxford.

MR. A. W. SMITH, C.B.E., who has recently retired from the position of general manager and secretary of the City of Birmingham Gas Department, has accepted an invitation to join the board of the Midland Tar Distillers, Ltd., as from July 1.

The following have been elected members of the Institution of Chemical Engineers: W. J. CHADDER, M.Inst. Gas E., The Woodall-Duckham Co.; G. E. FOXWELL, D.Sc., F.Inst.P., F.Inst.F., Clayton, Son & Co., Ltd.; N. W. GREY, Celanese Corporation of America; A. H. NEWEY, M.Sc., Cadbury Bros., Ltd.; A. J. C. OLSEN, B.Sc., Distillers Co., Ltd.; D. G. PERKINS, Coty (England), Ltd.; E. E. UNWIN, M.Sc., F.R.I.C., Frederick Allen & Sons (Poplar), Ltd.

PROFESSOR R. WHYTLAW-GRAY, O.B.E., F.R.S., has announced his intention to retire from the chair of chemistry in the University of Leeds, which he has held for over twenty years. This has led to a reorganisation of the chemistry departments. The Council has decided to unite the departments of inorganic and physical chemistry into a single unit with two professors of inorganic and physical chemistry, of whom PROFESSOR M. G. EVANS, who has hitherto held the chair of physical chemistry, will be the senior. The Council has also appointed DR. E. G. COX to the second chair in the new department. Dr. Cox, who is at present serving as technical staff officer with the 21st Army Group, was for two years research assistant to Sir William Bragg in the Davy-Faraday Laboratory. Since 1929 he has been on the staff of Birmingham University, where he occupies the post of Senior Lecturer in Physical Chemistry and Reader in Crystallography. His research work has been mainly concerned with the structure of carbohydrates and of inorganic co-ordination compounds. The Department of Organic Chemistry will remain under the direction of Professor Challenger.

Obituary

MR. JAMES CROOKSTON, chairman of the Egyptian Phosphate Company, Ltd., died at Weybridge on March 24.

MAJOR RICHARD ARTHUR ORMEROD CLAUDET, B.Sc., A.R.I.C., A.Inst.M.M., who died at Worthing on April 1, aged 49, was a director of F. Claudet, Ltd., assayers and metallurgical chemists, of London. He was educated at Aldenham and King's College, London, and served in the Royal Artillery in 1914-19, becoming an associate of the Royal Institute of Chemistry in 1924.

MR. RICHARD LIVESEY, who died at Radcliffe, Lancashire, on March 12, aged 68, had retired from business life in 1940, after fifty years' service with the Wall Paper Manufacturers, Ltd., and allied companies, having joined Messrs. Osborn & Shearman as office-boy in 1890 at Chelsea. In 1916-34 he was north-west representative of the Osborn & Shearman branch (Fulham), and from 1934 to his retirement he represented the F. W. Howarth branch (Blackley).

MR. JAMES ROBINSON, who died at Colwyn Bay, North Wales, on March 27, aged 77, was a director of Mather & Platt, Ltd., and one of the best known engineers in the Manchester district. He was a foundation member of the Manchester Engineers' Club. He entered the firm's works as an apprentice over 60 years ago, and he eventually became managing director of the department responsible for the production of bleaching, dyeing, and finishing machinery, a subject on which he was a world-renowned authority.

MR. WILLIAM COWEN, A.M.I.Chem.E., whose death at the age of 41 is reported, was widely known among students of chemical engineering as lecturer in that subject at the Manchester College of Technology, a post which he held from the foundation of the course in 1933 until last September. He had previously been employed with I.C.I. (Fertiliser & Synthetic Products), Ltd., and last year he returned to industry as chemical engineer to Lansil, Ltd., Lancaster.

General News——From Week to Week

Ministry of Labour employees have contributed £31,200 to the Red Cross Penny-a-Week Fund.

DTD Specification 174A (Amended list No. 1) on Aluminium Bronze Sand or Die Castings has just been issued by the M.A.P.

An aluminium alloy house, designed by the Aircraft Industries Research Organisation on housing has passed its technical tests, says the Ministry of Works.

Two pharmacists have been appointed to the chemical industry branch of the British element of the Allied Control Commission for Germany, to act respectively as assistant director and as personal assistant to the deputy director-general.

Metallurgists should be interested in the following DTD specifications which have just been issued: 265A, Hard Drawn Phosphor Bronze Bars and Tubes (1s.; superseding No. 265); 355, Silicon-Iron Bronze Castings Amendment List No. 1 (1d.); 412, Aluminium Bronze Sand or Die Castings Amendment List No. 1 (1d.); 903A, Zinc Plating (1s.; superseding No. 903).

With the partial relaxation of security regulations, the "600" group of companies—George Cohen, Sons & Co., Ltd., and allied concerns—have been able to make an interim statement about their war production. Lack of space prevents us from giving full details of their achievement, but it may be said that few companies can have had a more varied output, ranging, as theirs does, from over 2,000,000 aerial bomb components to a large part in the construction of reinforced caissons for " Mulberry " harbour.

Important proposals for ending the smoke nuisance by the setting up of smokeless zones are described in some detail in a new booklet published by the National Smoke Abatement Society. In such zones the emission of *any* smoke would be an offence, and a beginning would be made with zones in central and reconstructed areas. Once these were established, and as improved appliances and fuels became fully available, the initial zones would be progressively expanded until, after a period of about ten years, the whole of the towns would enjoy smokeless air. Copies of *Smokeless Zones* may be obtained direct from the Society at Chandos House, Buckingham Gate, London, S.W.1, at 3d. each, post free.

The Beecham group has formed three new companies, each with a nominal capital of £100, for the purpose of carrying on export business in various branches of manufacture in which they are interested. The new companies are County Perfumery International Products, Ltd.; Macleans International Products, Ltd.; and Phensic International Products, Ltd. Sir Joseph Holmes (chairman, Beechams Pills, Ltd.), Mr. G. A. Dunbar (managing director, Beecham Export Corporation, Ltd.), and Mr. B. L. Hobrow (director, Beechams Pills, Ltd.) are directors of all three companies.

The annual report of UFAW (Universities Federation for Animal Welfare) notes that the fumigation method of exterminating wild rabbits does not appear to have made much headway, despite the grant of a 50 per cent. subsidy on dusts throughout the year, presumably because of farmers' reluctance to lose the opportunity of a cash profit on their rabbits. Letters have appeared, at the Federation's instance, in the Press, pointing out the humaneness of fumigation with cyanide or exhaust gas, and the inhumaneness of fumigation with sulphur dioxide. Readers may be reminded that UFAW's attitude to scientific experiments on animals is correctness itself; their business is to see that laboratory animals receive fair treatment.

Foreign News

Although Tanganyika produced only very small quantities of pyrethrum before the war, the territory has, in spite of the great strain on manpower, 5300 acres under the crop.

A division for polymer chemistry, the first of its kind in the U.S.A., has recently been formed at the Brooklyn Polytechnic Institute.

Among new companies registered in the Union of South Africa are the Plastics and Chemicals Co., Ltd., Johannesburg, with a nominal capital of £10,000, and the West African Aluminium Co., Ltd., Johannesburg, with a nominal capital of £250,000.

Valuable experience in the production of magnesium has been obtained in the development of a private carbothermic magnesium plant in California for the production of magnesium dust, known as goop, to fill incendiary bombs.

Sweden's glassworks, excluding window glass and bottle manufacturers, have founded a new export organisation, while the formation of a jointly-run laboratory, to exercise control of the quality of Swedish glass products, is being discussed.

Canada's imports of chemicals in 1944 amounted to $80,843,000, comparing with $70,548,000 in 1943. Imports of non-ferrous metals fell from $115,567,000 to $106,651,000, while those of non-metallic minerals rose from $250,943,000 to $271,014,000. There was a decline in the value of scientific equipment imports from $9,809,000 to $8,451,000.

Forthcoming Events

April 7. Institution of Factory Managers. Bonnington Hotel, Southampton Row, W.C.1, 2.30 p.m. S.E. London branch meeting.

April 9. Society of Chemical Industry (London Section). Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1, 2.30 p.m. Dr. A. Parker (Director of Fuel Research): "Coal, Science, and the Future."

April 11. Electrodepositors' Technical Society (Birmingham Section). James Watt Memorial Institute, Great Charles Street, Birmingham, 3, 6.45 p.m. Mr. S. Wernick: "The Plating Shop, Plant and Lay-out."

April 12. Institute of Fuel. Annual meeting, City and Guilds Engineering College Lecture Room, Exhibition Road, London, S.W.7, 2.30 p.m.

April 12. Society of Chemical Industry and **Institute of Metals** (London Sections). The Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 7 p.m. Mr. A. R. Powell: "Minor Metals."

April 13. Society of Chemical Industry (Plastics Group, and Birmingham and Midland Section). Chamber of Commerce, New Street, Birmingham, 6.30 p.m. Dr. K. W. Pepper and Dr. F. T. Barwell: "Fabric-Base Plastics."

April 12. Society of Chemical Industry (R. & B.M. Group), 1 Grosvenor Place, S.W.1, 4 p.m. Professor Bernard H. Knight, University of Witwatersand: "The Physical Properties of Road Aggregates as Affecting Road Performance." (Communication presented by Mr. L. G. Gabriel.)

April 12 and **13. Institute of Physics** (X-ray Analysis Group). 1945 Conference. Royal Institution, 21 Albemarle Street, London, W.1. Chairman: Professor Sir Lawrence Bragg. **April 12**: 10.15 a.m., short papers on new and improved methods of use of X-ray diffraction; 1.30 p.m., annual general meeting of the group; 2 p.m., discussion on "The Equipment of a Laboratory for X-ray Analysis"; contributors: Dr. R. F. Hanstock, Mr. H. S. Peiser (I.C.I. Alkali), and Dr. W. A. Wooster; 8 p.m., Professor J. D. Bernal: "The Future of X-ray Analysis." **April 13**: 10 a.m., discussion: "The Interpretation of X-ray Diffraction by Optical Principles"; contributors: Professor Sir Lawrence Bragg, Dr. H. Lipson, Dr. L. J. Comrie, and Professor J. M. Robertson; 3.30 p.m., discussion on the proposal to convert X-ray wavelengths to absolute values.

April 13. Institution of Chemical Engineers. Annual meeting, Connaught Rooms, Great Queen Street, London, W.C.2. 11 a.m., Business session (corporate members only). 12 noon, President's address: "A Byway in Chemical Engineering." 1 p.m., Luncheon (principal speaker, Sir Stafford Cripps). 3 p.m., Mr. H. W. Cremer and Mr. R. L. Fitt: "The Siting and Lay-out of Industrial Works."

April 16. Royal Society of Arts. John Adam Street, Adelphi, W.C.2, 1.45 p.m. Cantor Lecture. Sir Frank Smith: "Synthetic Chemicals from Petroleum.—I."

April 17. The Institute of Physics (London and Home Counties Branch). Rooms of the Royal Society, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Dr. S. Tolansky: "Some New Contributions to Interferometry with Applications to Crystal Studies."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

JAMES E. SMITH (WAKEFIELD), LTD., chemical manufacturers. (M., 7/4/45.) March 8, mortgage, to Dewsbury and W. Riding Building Society, securing balance of an account current; charged on Barrowcliffe House, Headlands Lane, Westfield, Ossett.

Satisfactions

METALIN, LTD., Bletchley. (S., 7/4/45.) Satisfaction March 14, of debentures registered May 26, 1933, to the extent of £1700 (total issued).

WESTERN OXIDE & PAINT CO., LTD., Plymouth. (S., 7/4/45.) Satisfactions March 12, £2500, registered October 20, 1931. £272 10s. registered December 30, 1931, and £1000 registered March 18, 1933.

Company News

Blythe Colour Works, Ltd., report a trading profit, for the year 1944, of £56,393 (£25,762). The dividend is raised from 5 per cent. to 30 per cent.

African Explosives & Chemical Industries, Ltd., have made a trading profit, for the year ended September 30, of £1,040,140 (£1,104,559). The dividend remains at 20 per cent..

Lewis & Burrows, Ltd., are paying a dividend of 5 per cent. (10 per cent.) for the year ended September 30. Profit before taxation was £21,052 (£16,747).

Benzol and By-Products, Ltd., report a trading profit, for the year to September 30, of £84,965 (£81,534), and a net profit of £34,760 (£34,673). Debt has been reduced from £43,727 to £7306.

Manganese Bronze & Brass Co., Ltd., have made a net profit, for 1944, of £151,161 (£230,405). A final ordinary of 17½ per cent., again making a total of 25 per cent., has been declared.

The Chinnor Cement and Lime Co., Ltd., reports a net profit, for 1944, of £6130 (£11,762). A final of 5 per cent. (7½ per cent.), making 7½ per cent. (10 per cent.), has been paid.

Hickson & Welch, Ltd., chemical manufacturers, Castleford, Yorks, have increased their nominal capital by the addition of £8000 in £1 shares beyond the registered capital of £2000.

British Cellulose Lacquers, Ltd., London, E.C.2, have increased their nominal capital by the addition of £30,000 6 per cent. redeemable cumulative preference £1 shares, beyond the registered capital of £6000.

James E. Smith (Wakefield), Ltd., chemical manufacturers, have increased their nominal capital, beyond the registered capital of £1000, by the addition of £6000 in 1000 ordinary and 5000 preference shares of £1 each.

Beechams Pills, Ltd., have declared a third interim dividend of 17 per cent., making a total of 32 per cent. (same) for the year ended March 31. The profit is expected to be as large as, if not larger than, last year's figure.

The British Oxygen Company is proposing to issue 1,000,000 cumulative second preference £1 shares at par, which will be provisionally allotted to existing ordinary stockholders in the proportion of one new preference share to every £3 10s. ordinary stock or fraction thereof. The new shares will carry a cumulative dividend of 4 per cent., though they will rank both for dividend and capital with the £1,000,000 5 per cent. second preference capital already in issue.

Chemical and Allied Stocks and Shares

STOCK markets have been firm and slightly more active, sentiment reflecting war news and the strength of British Funds. Industrial shares showed small gains, where changed, and there has been further speculative activity in European bonds at higher prices, including German Potash issues. Argentine Rails also received somewhat more attention on post-war hopes. Among Industrials, a feature was the improvement to 34s. in British Celanese, with Courtaulds higher at 56s. on revived market talk of a possible working agreement between the two companies.

Imperial Chemical at 39s. 4½d. were well maintained, awaiting the dividend announcement. Lever & Unilever, however, eased to 47s. although Lever N.V. had a firmer appearance at 47s. 3d. because, with the forthcoming liberation of Holland, up-to-date particulars of the latter company will become available. Amalgamated Metal shares firmed up to 18s. 6d. on the dividend, and on expectations that pre-war dividend payments seem likely to be regained in due course. Imperial Smelting shares at 14s. 7½d. were also better, while General Refractories kept steady at 16s. 6d. British Oxygen have been firm at 90s. on the preference share offer, but British Aluminium at 44s. 10½d. were little changed on further consideration of the statements at the recent meeting. Borax Consolidated deferred kept steady at 39s. Firmness was shown by Barry & Staines at 53s. 9d., and by Nairn & Greenwich at 77s. 6d. Wall Paper Manufacturers deferred have been well maintained at 44s. Dunlop Rubber were good, rising to 50s., and the units of the Distillers Co. have been steadier at 111s. 3d. In other directions, British Plaster Board at 39s. 6d. have not held best levels, but Associated Cement were steady at 61s. 9d., and Rugby Cement 5s. shares strengthened to 11s. 6d.

Awaiting the dividend statement, Stewarts & Lloyds were firm at 57s. 9d., with Tube Investments changing hands slightly over £5½. Ruston & Hornsby at 53s. 9d. were good on market dividend estimates. Guest Keen firmed up to 39s., while United Steel kept steady at 26s. 9d., and Dorman Long at 27s. 3d. Colliery shares generally were little changed. Among textiles, Bradford Dyers showed steadiness at 26s. 3d., and Fine Spinners were good at 25s. 6d., the latter reflecting current dividend estimates. Calico Printers at 18s. 6d., and Bleachers at 14s. were little changed on balance. In other directions, Gas Light & Coke ordinary firmed up to 24s. Low Temperature Carbonisation 2s. units were 2s. 9d.

De La Rue moved higher at £11 7/16 on increased dividend talk, while British Industrial Plastics 2s. shares have again been active around 2s. 9d., and Erinoid were 12s. 3d. Goodlass Wall 10s. ordinary kept well maintained at 19s. International Paint shares moved higher at 120s. B. Laporte were 78s., British Drug Houses 30s. 3d., Burt Boulton 27s., and elsewhere, Greeff-Chemicals Holdings 5s. shares were dealt in up to 9s. 7½d. Reflecting the higher distribution, William Blythe 3s. shares changed hands up to 11s. 6d. before going "xd,"

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and Blythe Colour Works 4s. shares were dealt in up to 18s. United Glass Bottle were around 74s. 6d., and Key Glassworks have transferred up to 70s. Triplex Glass 10s. ordinary were little changed at 42s. 6d., the small yield indicating continued hopes that eventually pre-war rates of dividend are likely to be regained, although it is recognised that this may, of course, be a gradual process. In other directions, Boots Drug were firm at 56s. 3d., Timothy Whites 41s. 6d., and Sangers 31s. 7½d. Oil shares have been more active and generally firm, with Anglo-Iranian 111s. 10½d., Burmah Oil 87s. 6d., Lobitos 55s. 6d., and Shell 83s. 1½d.

British Chemical Prices

Market Reports

THE London general chemicals market throughout displays an even tone despite a slight easing of the pressure for deliveries and absence of fresh inquiry due to holiday conditions. The demand for the soda products continues on a good scale, with offers of chlorate of soda and bichromate of soda scarce, while in the potash section supplies of yellow prussiate of potash are limited and there is a ready market for caustic potash, permanganate of potash, and bichromate of potash. Acid phosphate of potash is a good market. Among the acids a steady demand is maintained for acetic and oxalic, with supplies scarce. Hydrochloric acid is in good request and a moderate demand is reported for salicylic acid. Trade in coal-tar products has been on a moderate scale during the past week, with steady deliveries of crude carbolic and cresylic acid against contracts. Offers of naphthalene are quickly absorbed, while the toluols and benzols are steady. A moderate trade continues in pitch.

MANCHESTER.—From the point of view of contract deliveries and of new business slacker conditions have been reported on the Manchester chemical market during the past week, but the slowing down is attributed mainly, if not entirely, to the Easter holiday conditions, and livelier trading is anticipated again as soon as the consuming works regain their stride. Deliveries of the alkalis and most of the other leading "heavies" since last report have been on a moderate scale. Prices generally have kept steady to firm. Exceptionally, lower rates for borax and boric acid came into force at the beginning of the week.

GLASGOW.—In the Scottish heavy chemical trade business during the past week has shown an improvement. Export trade inquiries are becoming more numerous. Prices remain firm at previous levels.

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